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By A. W. NICHOLSON M. D., of Otisville.

A PAPER READ AT THE SANITARY CONVENTION AT FLINT, MICHIGAN, JAN. 26, 1881.

[Reprinted from the Ninth Annual Report of the Michigan State Board of Health, for the year 1881.]



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Although the field is being repeatedly gone over, the material that goes to make up the subjects belonging to the science of sanitation certainly seems limitless. Concerning this science we can imagine no end to experimental inquiry—no end to the development of new facts and new philosophies, for it deals with the health and happiness of humanity.

The city has its dangers to health, and the sanitarian for years has been directing his attention to the removal of these dangers; to defects in the construction of its dwellings; to its system of sewerage; to the removal of its multiple evils that make sickness and cause death among its inhabitants. Although the city may abound with "contrasts of splendid intentions, and mis-carried achievements" in reference to its sanitary regulations, successful indeed have been the labors of the sanitarian for the benefit of its inhabitants.

The rural districts close about your cities have their dangers to health, and for the special weal of its residents, much is written by which they may obtain valuable knowledge that will enable them to improve their sanitary surroundings. In the urban and in the rural districts, the benevolence of some citizen, or some civic regulations, or the wealth of the individual owner usually serves to bring about a practical application of the suggestions science has made.

But there is another class of people who naturally are subjected to *some* dangers to health different from those to which the classes just referred to are subjected, and that are often greater. We refer to the class of pioneers, they, who by the peculiarity of their situation are greatly debarred from profiting by scientific information of vital importance to them. They are, as a class, extremely poor. They enter the wilderness to build a home for themselves and their families, almost in total ignorance of any laws that govern health, or of the methods of scientific farming, and their whole environment is such, at present, that we cannot expect them to be well informed in regard to any such laws or methods. We can picture in our minds a colony of pioneers who, more than two centuries and a half ago, at New Plymouth, laid the corner-stone of prosperity to that State that was the first of this nation to make itself preëminent in the interests of State medicine; their want of proper habitations; their lamentable sicknesses, and losses by death. Not twenty miles from this city are pioneers to-day, subject almost to the same hardships, almost to the same disasters, carving at the initial steps to the prosperity of Michigan. The stroke of the axe in the forest primeval is there, and the ill-constructed habitation, with too little light, and too much ventilation.

To a great extent, many of the unpleasant conditions that surround the life of the pioneer, are not alterable by the measures that the literature of a sanitary science has offered; and the first stroke of the axe is a premonition of dangers that seem sure to appear.

Not often can a Utopia spring into existence in an uncultivated waste, without the painful labors and deprivations of a settler's life, like the city that suddenly lifted itself to view upon the barrens of Hempstead Plains—the Garden City of Long Island, with its pure water, and perfect dwellings, "constructed with an eye to artistic effect," for the benefit of a coming citizen.

If the new settler has *any* knowledge of a system of drainage it is pretty sure to relate to the improvement of the productive qualities of the soil and not to health matters. His house is hurriedly constructed on account of pressing labors in other directions. In selecting his site he is apt to pay little attention to the facilities for sub-soil drainage. He often builds over a natural excavation in the earth that may serve as a receptacle for fresh vegetables in the fall and for decaying vegetable debris in the spring. He, through an absence of the proper knowledge, or a proper appreciation of the importance of the subject, disregards the provision that the floor of the house should be "impermeable to wet and laid so as to exclude ascending moisture and earth exhalations." The ill-constructed *floor* is one of the greatest dangers to which the new settler is commonly subjected. Too often may deaths and prolonged sicknesses be traced to this evil; and it is a common evil among them. The air of the room whenever artificially heated will, to an extent according with the degree of its temperature, become permeated with moisture, and the higher the temperature the greater will be the moisture, providing there exists a free communication to a humid atmosphere outside. If beneath the floor is a damp soil, or a pool of water, there certainly will be a dangerous degree of dampness in the room above. It is an exception to the general rule when sickness does *not* occur when these conditions are present. We have seen all the members of a large family stricken with serious sickness, one of whom died, where the circumstances just described existed. Their sickness was of such a nature as to preclude a theory of contagion in reference to the cause. The cause was more emphatically traced to the rising vapor, or to the poisonous germs trans-

ported by it. The majority of the houses are so rudely constructed as to have a constant free communication between the internal and external air, both containing an equal amount of moisture, or nearly so, when the air of the house is *not* artificially heated. When the temperature of the house is *increased* artificially, a circumstance that frequently obtains from necessity, the amount of moisture therein will *exceed* that of the external air, or the air of the room will even be saturated. What is saturated air? For the convenience of estimating the relative amount of moisture the air may contain, air that is saturated is said to hold one hundred per cent of moisture. Air most conducive to comfort or to health will contain about sixty-five or seventy per cent of moisture. This fact can easily be demonstrated by any one possessing a psychrometer, or any other instrument by which an estimate of the humidity of the atmosphere is made; and, such an instrument as this would be of value to any person. It will tell you, as we have stated, how much dampness there is in the air about you, and whether it is present to a dangerous degree. It will point out to you, in the hot days of summer, when to guard against sun-stroke, for hot days with excess of moisture, are the harbingers of that event. It will often tell you when to be merciful to the dumb brute as well as to yourself.

The dangers to health surrounding the home of the pioneer do not bear so strong a relation to its immediate contiguity to forests as to other circumstances. If too little sunshine at times seems to exist in the forest for the sustenance of health, this evil is often more than counterbalanced by its protection of the individual from the effects of the torrid heat of the sun which might be serious to one exposed on open undrained lands. Wherever man may choose to reside, whether at the equator or at the poles, a certain degree of temperature of the body must be maintained. His judgment and ingenuity are exercised to maintain this equable temperature by the invention of proper apparel, and of various other ways to meet the vicissitudes of climate. Too great, or too little radiation of heat from the body will produce a physiological disturbance. The forest shields the pioneer from the fierce winds of winter, preventing a large loss of heat necessary for the body to retain, and, in summer, while beyond the boundaries of the forest the air is still and burning, a gentle breeze within its borders greatly facilitates a healthy radiation of surplus heat from the body.

The dangers from imperfect drainage about the habitation of those who may live among the forest trees are greatly mitigated by the drainage that the roots of the trees themselves perform, absorbing much of the impurities of the soil, with its excess of moisture. Perhaps the residue of impurities, not taken up by the trees, that may arise in the exhalations from the ground may be neutralized, or destroyed, by the abundance of that subtle element ozone, or active oxygen, large quantities of which often exist in the forests.

But the time is sure to come when the destruction of the trees, opening the way to agricultural improvements, opens it to dangers not experienced in that locality before. The amount of moisture in the air over an open space fluctuates with its frequently varying temperature, depending greatly on the amount of dampness in the soil. The more porous the soil, as in an open sandy tract, the greater will be the evaporation. These frequent variations in the temperature and humidity of the air are deleterious to health. The amount of moisture in the atmosphere of the forest is subject to far less fluctuation. Its even, low temperature allows much of the moisture to be retained in the soil, a large

portion of the excess being taken up by the trees themselves. Wells and springs often dry up because of the removal of a growth of timber that prevented a rapid evaporation from the soil.

Prof. Ebermayer of Aschaffenburg, a few years ago, arrived at the following conclusions from his meteorological observations on forestry: "If from the soil of an open space one hundred parts of water evaporate, then from the soil of the forest, *free* from underwood, *thirty-eight* parts would evaporate, and from a soil *covered* with underwood only *fifteen* parts would evaporate."

One of the greatest dangers to health to which a pioneer is subjected is when he turns over the furrow of the new soil. It is difficult to tell what volumes of poisonous germs are concealed beneath its quiet surface, to be thrown into the air by the point of the plowshare. Also, the increased porosity of the soil, now crumbled and broken, has greatly increased its evaporating surface, unrelieved by any system of drainage, and what are the consequences? There is an excess of aqueous vapor in the air above it. The functions of the skin and lungs are interfered with because the natural exhalations from these organs are prevented. If the air contains as much aqueous vapor as it is able to contain, that is, is saturated, there is a suspension of evaporation from surrounding objects, and man is no exception to this general rule. Sickness would be the consequence were any one exposed to such conditions for any length of time. It has even been doubted whether life can be prolonged in air saturated with moisture, with a temperature of 90° or 100° Fahrenheit. Many times have we known of instances where repeated exposures to conditions bordering on this extreme have resulted in the loss of a year's labor and expectations, because of the sickness that followed.

The pioneer is fortunate if he selects land with soils least calculated to be generators of sickness. Observations teach us that that soil which is most porous, beneath which may lie a sub-soil retaining great quantities of moisture within itself or upon its surface, is the most unsafe. Sandy soil above such a sub-soil therefore would absorb a great amount of moisture from beneath, which would be rapidly evaporated, perhaps loading the atmosphere with other elements of disease than that of dampness. In over one hundred cases of fever coming under our own observation during eight months of the year 1877, most of the cases of which were in families of those recently located upon new lands, about 90 per cent were where they were subjected to the continued influence of emanations from undrained sandy soil.

In Michigan it is not uncommon for a pioneer to select a site in the forest contiguous to low swamp lands; perhaps such swamps are a part and parcel of his own territory. Not comprehending or appreciating the dangers resulting from such an action, he removes the belt of trees interposed between his dwelling and the low marshy tract. The sudden sickness that is apt to follow indicates some new danger. It cannot be doubted that this new danger is caused by the destruction of the trees intervening between the dwelling and the marsh. It may be that the trees serve as a screen, intercepting infectious germs that in the absence of the foliage would penetrate to the atmosphere of the dwelling. Certainly the removal of these vegetable growths would be a removal of a strong factor in the prevention of an excess of atmospheric moisture about the dwelling.

As an illustration of the absorbing qualities exhibited in some trees, the eucalyptus, or gum tree, it is said, will eliminate from a swampy soil eight times its own weight in water in twenty-four hours.

The Popular Science Monthly tells us: "The civic station of Futtahpoor is

situated between Allahabad and Cawnpoor, in an arid plain, but near a pretty extensive marsh. This place was considered extremely unhealthy until the magistrate planted between the station and the swamp a belt of quick-growing babool trees. As the trees grew the place became much less unhealthy.” The writer of the article supposes these trees to have acted as a screen, preventing the diffusion of poisonous germs to the inhabited plain.

Another danger to which the pioneer is apt to be subjected is from the absence of pure water as from deep wells or of wholesome spring-water. It is not uncommon for him to depend upon surface water from an excavation in the soil, and sickness from the use of it is a frequent consequence. His attention is wholly directed to the clearing of his lands as of chief importance. He has no time to consider the advantages of drainage or of the construction of a well, or of any proper sanitary surroundings. The pollution of the water he often uses is sensible to the “sight, the taste, and the smell,” or perhaps he does not recognize any source of contamination until the “doctor comes.”

The character of the drinking-water is a subject that is receiving, and should receive, widespread attention. Although many of the elements of contamination that are discovered in the drinking-water in cultivated districts are not contained in the surface-water of the wild lands, the frequent mixture with the latter of the soil itself, together with much organic material, makes the use of it dangerous. In regard to the use of impure drinking-water, the following incident is related: “Recently a clergyman actually preached to his parishioners that a devastating fever among them was a visitation from God upon them in punishment for their sins, while at the same time a gentleman, writing to the authorities to complain of the water-supply, dipped his pen in and wrote with the water from the river instead of ink.” However much we may honor the discernment of the gentleman mentioned, was not the clergyman right in this instance? Is it not a sin to disregard the laws of health instituted by the Divine Creator that are so plainly manifest; and are not devastating sicknesses often plainly retributions in consequence of somebody’s disregard of natural laws that are easily discernible? To plead ignorance of the law, is no extenuation for the crime, as viewed in the statutes.

The English commissioners a few years ago classified potable waters as follows: As wholesome—1, spring-water; 2, deep well-water; 3, upland water. As suspicious—1, stored rain-water; 2, surface-water from cultivated lands. As dangerous—1, River-water to which sewage gets access; 2, shallow well-water. The latter is that commonly used by the new settler.

Were a statistician to record the individual cases of sickness actually occurring in these new regions, and compare the number with the number of cases as existing in well-drained and well-cultivated districts, the result of the comparison would, I am sure, be startling; and the loss to the State of the important results of labor by the idleness of its members from avoidable sickness, would supply food for serious reflection to the political economist. In a lumbering and pioneer community with a population estimated at 150, we have known more than one-fourth of the inhabitants to be under the care of physicians at one time.

If our pioneer were an alumnus of our Agricultural College he would be prepared to meet the dangers before him. He would utilize his knowledge in choosing a site for his dwelling in the wilderness. He would take into consideration the topography and the geology of the situation for the sake of drainage. He would see that the soil upon which he would place his habitation was such as to admit of immediate drainage, and that this significant matter was

accomplished before a sill was laid toward the construction of it. He would select a point, no doubt, where the water-line was deepest beneath the surface. Perhaps he would place his house upon a southern, in preference to a northern, slope of land, on account of the condensation of moisture being less upon the former than upon the latter, for some of the vapor of the warm south wind from the open country is pretty sure to become condensed when it reaches the cooler atmosphere upon the less sunny side of the northern slope. Who has not experienced the discomforts that exposures to chilly fogs give rise to? It is well known that a certain degree of constant moisture, especially in the soil, is essential to forest growth. In accordance with this fact a northern slope should be the location generally chosen for a range of this growth, on account of the precipitation of the moisture that is condensed by coming in contact with its cool air. In addition to other benefits, trees planted in this situation would act as a shelter from northern winter winds. Also for reasons previously stated, the pioneer should either plant or allow to remain standing a belt of trees intervening between his house and any low, marshy, undrainable parcel of land where the ground-water is subject to frequent rise and fall, saturating the soil with moisture as it rises, and as it descends leaving a large surface from which a speedy evaporation must ensue.

Another source of danger accompanying pioneer life is the usually grave influence of his surroundings upon the course of contagious diseases. The liability to death, or even attack, from these diseases, is certainly greatly lessened by the presence of good sanitary surroundings. It is not a flight of the fancy that enables us to picture a habitation built of logs with wide interstices between each of them, where the dank air from a region of swamp upon which it is situated sweeps through it; and this where six of a family of seven are suffering from diphtheria. It is needless to say that the pale horse visits this dwelling as it does others similarly situated.

But, alas! there is an absence of a consideration of matters relating to the general laws of health on the part of the pioneer because of his pecuniary circumstances never having admitted of his obtaining such a preliminary education as would prepare him for the perils to which he must be subjected; or because he has not had free access to the proper literature that would enlighten him upon these subjects.

If our generous State, through principles of political economy, does not deem it expedient to institute measures for the increased diffusion of sanitary knowledge that will render less the unnecessary loss of life and labor in the ranks of its vanguard of citizens; or, if local boards of health, who are the legal protectors of the public health, cannot recognize the adoption of such measures as related to their guardianship, then there is a field left open for the labors of the philanthropist.

When the pioneer enters into this field of unknown perils, well may he say, like the slaves in the desert who cried unto the Lord to look to them across the shining sands, Lord, look to us across this wilderness!—

“Thro’ the furnace of the noon,
Thro’ the white light of the moon,
Thou, our morrow’s pathway knowing
Thro’ this strange world round us growing,
Speak! and tell us where we are going.
We are weak, but thou art strong,
Short our lives, but thine is long;
We are blind, but thou hast eyes,
We are fools, but thou art wise”

DISCUSSION.

I. N. Smith, M. D., health officer of Saginaw, spoke favorably of Dr. Nicholson's paper, and added several points which he thought should be considered in such a connection—namely, the direction from which the prevailing winds come (which was southwest in this State) and the importance of so locating houses and outbuildings that the prevailing winds shall not bring to the house exhalations from swamps, barns, privies, etc. He mentioned the importance of placing privies distant from wells.

In response to a question as to whether water from a well, or filtered cistern water was safest in cities and villages, Prof. Vaughan, stated some facts bearing upon the subject. Lithium was sown upon the surface and afterward found in water at a great distance.

H. P. Seymour, M. D., of Byron, spoke on the subject of contamination of water, giving details of the outbreak of typhoid fever at Lausanne, Switzerland, and making the point that filters were not to be depended upon to take out really dangerous impurities in water.

H. C. Fairbank, M. D., of Flint, gave some facts relative to four cases of typhoid fever connected with the use of spring-water of offensive odor and taste, about sixty feet below a "water closet" (privy?). The persons abandoned the use of the spring, dug a new well, and typhoid fever had not appeared there since.

Rev. Mr. Tyndall, of Flint, spoke of the underground currents of water and the impossibility of learning the real source and quality of water except by testing of every well.

Prof. Kedzie gave details of cases of sickness in two families occupying the same house, and the cessation of sickness when a new source of water-supply was procured.